

What is claimed is:

1. A semiconductor device for driving a switching device having a first electrode, a second electrode, and a control electrode, said semiconductor device
5 comprising:

a first terminal connected to said first electrode;

a second terminal connected to said first electrode through a capacitive element;

a semiconductor substrate having a first conductivity type;

a first impurity region formed in a main surface of said semiconductor substrate
10 and having a second conductivity type;

a second impurity region formed in a main surface of said first impurity region
and having said first conductivity type;

a first transistor having a source/drain region of said second conductivity type,
said source/drain region of said first transistor being formed in a main surface of said
15 second impurity region and connected to said first terminal;

a second transistor having a source/drain region of said first conductivity type,
said source/drain region of said second transistor being formed in said main surface of
said first impurity region and connected to said second terminal; and

at least one of a third impurity region having said first conductivity type,
20 formed in said main surface of said first impurity region, and connected to said first
terminal and a fourth impurity region having said second conductivity type, formed in
said main surface of said first impurity region, and connected to said second terminal.

2. The semiconductor device according to claim 1, wherein said third
25 impurity region is formed in contact with said second impurity region and to surround

said second impurity region continuously or intermittently.

3. The semiconductor device according to claim 1, further comprising a fifth impurity region formed in said main surface of said first impurity region, having said first conductivity type, and connected to said first terminal.

4. The semiconductor device according to claim 3, further comprising an isolation region having said first conductivity type and formed in said main surface of said semiconductor substrate and in contact with said first impurity region,

10 wherein said fifth impurity region is formed between said isolation region and said second impurity region and surrounds said second impurity region continuously and intermittently.

5. The semiconductor device according to claim 1, further comprising:
15 a fifth impurity region formed in said main surface of said first impurity region, having said first conductivity type, and connected to said first or second terminal;

a trench formed in said main surface of said first impurity region and extending through said fifth impurity region; and

a sixth impurity region formed in said first impurity region in a portion that
20 defines wall surfaces of said trench, having said first conductivity type, and connected to said first or second terminal.

6. The semiconductor device according to claim 5, further comprising an isolation region having said first conductivity type and formed in said main surface of
25 said semiconductor substrate and in contact with said first impurity region,

wherein said fifth and sixth impurity regions are formed between said isolation region and said second impurity region and surround said second impurity region continuously or intermittently.

5 7. The semiconductor device according to claim 1, further comprising an isolation region having said first conductivity type and formed in said main surface of said semiconductor substrate and in contact with said first impurity region,

 wherein said fourth impurity region is formed between said isolation region and said second impurity region and surrounds said second impurity region continuously or
10 intermittently.

8. A semiconductor device for driving a switching device having a first electrode, a second electrode, and a control electrode, said semiconductor device comprising:

15 a first terminal connected to said first electrode;
 a second terminal connected to said first electrode through a capacitive element;
 a semiconductor substrate having a first conductivity type;
 a first impurity region formed in a main surface of said semiconductor substrate and having a second conductivity type;

20 a second impurity region formed in a main surface of said first impurity region and having said first conductivity type;

 a first transistor having a source/drain region of said second conductivity type, said source/drain region of said first transistor being formed in a main surface of said second impurity region and connected to said first terminal;

25 a second transistor having a source/drain region of said first conductivity type,

said source/drain region of said second transistor being formed in said main surface of said first impurity region and connected to said second terminal; and

at least one of a third impurity region formed in said main surface of said first impurity region, having said first conductivity type, and connected to said first terminal
5 and a fourth impurity region formed in said main surface of said first impurity region, having said first conductivity type, and connected to said second terminal.

9. The semiconductor device according to claim 8, further comprising an isolation region having said first conductivity type and formed in said main surface of said semiconductor substrate and in contact with said first impurity region,
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wherein said fourth impurity region is formed between said isolation region and said second impurity region and surrounds said second impurity region continuously or intermittently.

15 10. A semiconductor device for driving a switching device having a first electrode, a second electrode, and a control electrode, said semiconductor device comprising:

a first terminal connected to said first electrode;

a second terminal connected to said first electrode through a capacitive element;

20 a semiconductor substrate having a first conductivity type;

a first impurity region formed in a main surface of said semiconductor substrate and having a second conductivity type;

a second impurity region formed in a main surface of said first impurity region and having said first conductivity type;

25 a first transistor having a source/drain region of said second conductivity type,

said source/drain region of said first transistor being formed in a main surface of said second impurity region and connected to said first terminal;

a second transistor having a source/drain region of said first conductivity type, said source/drain region of said second transistor being formed in the main surface of said first impurity region and connected to said second terminal;

a third impurity region formed in said main surface of said first impurity region, having said first conductivity type, and connected to said first or second terminal;

a trench formed in said main surface of said first impurity region and extending through said third impurity region; and

a fourth impurity region formed in said first impurity region in a portion that defines wall surfaces of said trench, having said first conductivity type, and connected to said first or second terminal.

11. The semiconductor device according to claim 10, further comprising an isolation region having said first conductivity type and formed in said main surface of said semiconductor substrate and in contact with said first impurity region,

wherein said third and fourth impurity regions are formed between said isolation region and said second impurity region and surround said second impurity region continuously or intermittently.

12. The semiconductor device according to claim 10, wherein said trench is deeper than said second impurity region.

13. A semiconductor device for driving a switching device having a first electrode, a second electrode, and a control electrode, said semiconductor device

comprising:

a first terminal connected to said first electrode;

a second terminal connected to said first electrode through a capacitive element;

a semiconductor substrate having a first conductivity type;

5 a first impurity region formed in a main surface of said semiconductor substrate and having a second conductivity type;

a second impurity region formed in a main surface of said first impurity region and having said first conductivity type;

a first transistor having a source/drain region of said second conductivity type,
10 said source/drain region of said first transistor being formed in a main surface of said second impurity region and connected to said first terminal;

a second transistor having a source/drain region of said first conductivity type, said source/drain region of said second transistor being formed in the main surface of said first impurity region and connected to said second terminal; and

15 at least one of a combination of a third impurity region formed in said main surface of said second impurity region, having said first conductivity type, and connected to said first terminal and a fourth impurity region formed in said main surface of said second impurity region and in contact with said third impurity region, having said second conductivity type, and connected to said first terminal, and a combination of a fifth
20 impurity region formed in said main surface of said first impurity region, having said second conductivity type, and connected to said second terminal and a sixth impurity region formed in said main surface of said first impurity region and in contact with said fifth impurity region, having said first conductivity type, and connected to said second terminal.

14. The semiconductor device according to claim 13, further comprising an isolation region having said first conductivity type and formed in said main surface of said semiconductor substrate and in contact with said first impurity region,

wherein said third and fourth impurity regions are formed between said
5 isolation region and said second impurity region and surround said second impurity region continuously or intermittently.

15. The semiconductor device according to claim 13, further comprising an isolation region having said first conductivity type and formed in said main surface of
10 said semiconductor substrate and in contact with said first impurity region,

wherein said fifth and sixth impurity regions are formed between said isolation region and said second impurity region and surround said second impurity region continuously or intermittently.

15 16. A semiconductor device for driving a switching device having a first electrode, a second electrode, and a control electrode, said semiconductor device comprising:

a first terminal connected to said first electrode;

a second terminal connected to said first electrode through a capacitive element;

20 a semiconductor substrate having a first conductivity type;

a first impurity region formed in a main surface of said semiconductor substrate and having a second conductivity type;

a second impurity region formed in a main surface of said first impurity region and having said first conductivity type;

25 a first transistor having a source/drain region of said second conductivity type,

said source/drain region of said first transistor being formed in a main surface of said second impurity region and connected to said first terminal;

a second transistor having a source/drain region of said first conductivity type, said source/drain region of said second transistor being formed in the main surface of said first impurity region and connected to said second terminal;

a third impurity region formed in said main surface of said first impurity region and having said first conductivity type;

a trench formed in said main surface of said first impurity region and extending through said third impurity region;

a fourth impurity region having said first conductivity type and formed in said first impurity region in a portion that defines wall surfaces of said trench;

a fifth impurity region having said second conductivity type and formed in said main surface of said first impurity region and in contact with said third impurity region; and

a floating electrode formed on said main surface of said first impurity region and in contact with said third to fifth impurity regions.

17. The semiconductor device according to claim 16, further comprising an isolation region having said first conductivity type and formed in said main surface of said semiconductor substrate and in contact with said first impurity region,

wherein said third to fifth impurity regions are formed between said isolation region and said second impurity region and surround said second impurity region continuously or intermittently.

18. The semiconductor device according to claim 16, further comprising a

sixth impurity region formed in said main surface of said first impurity region and having said second conductivity type, said sixth impurity region being in contact with said third impurity region on a side opposite to said fifth impurity region.

5 19. The semiconductor device according to claim 16, wherein said trench is deeper than said second impurity region.

20. A semiconductor device for driving a switching device having a first electrode, a second electrode, and a control electrode, said semiconductor device
10 comprising:

 a first terminal connected to said first electrode;

 a second terminal connected to said first electrode through a capacitive element;

 a first impurity region having a first conductivity type;

 a second impurity region formed in a main surface of said first impurity region
15 and having a second conductivity type;

 a first transistor having a source/drain region of said first conductivity type, said source/drain region of said first transistor being formed in a main surface of said second impurity region and connected to said first terminal;

 a second transistor having a source/drain region of said second conductivity
20 type, said source/drain region of said second transistor being formed in the main surface of said first impurity region and connected to said second terminal; and

 a third impurity region formed in said main surface of said first impurity region, having said second conductivity type, and connected to said first terminal.